Solving a wind turbine maintenance scheduling problem

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Résumé en anglais	Driven by climate change mitigation efforts, the wind energy industry has significantly increased in recent years. In this context, it is essential to make its exploitation cost-effective. Maintenance of wind turbines therefore plays an essential role in reducing breakdowns and ensuring high productivity levels. In this paper, we discuss a challenging maintenance scheduling problem rising in the onshore wind power industry. While the research in the field primarily focuses on condition-based maintenance strategies, we aim to address the problem on a short-term horizon considering the wind speed forecast and a fine-grained resource management. The objective is to find a maintenance plan that maximizes the revenue from the electricity production of the turbines while taking into account multiple task execution modes and task-technician assignment constraints. To solve this problem, we propose a constraint programming-based large neighborhood search (CPLNS) approach. We also propose two integer linear programming formulations that we solve using a commercial solver. We report results on randomly generated instances built with input from wind forecasting and maintenance scheduling software companies. The CPLNS shows an average gap of 1.2% with respect to the optimal solutions if known, or to the best upper bounds otherwise. These computational results demonstrate the overall efficiency of the proposed metaheuristic.
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